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cancel

Claim 95. A process in accordance with Claim 90, which comprises the step of performing an automatic animal related procedure on said animal based on said stress measurement data of said animal.

Claim 96. A process in accordance with Claim 90, wherein the step of measuring the degree of relatively momentary stress of said animal comprises making an infrared image of said animal.

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IN THE ABSTRACT:

Please cancel the Abstract on page 21 of the original Application in its entirety and substitute the Abstract of the Disclosure appended hereto.

**REMARKS**

This Amendment is in response to the Official Action dated December 19, 2002. In this Amendment, all claims, that is Claims 1, 2 and 36-40 have been cancelled without prejudice. Claim 51 is essentially the equivalent of cancelled Claim 40 set forth in a format more customary for U.S. patent claims and including all limitations of the base Claim 36 and the intervening Claims 36-39. However, all after "such as" in line 4 of cancelled Claim 37 has been omitted as surplusage. Independent Claim 53 in general corresponds to cancelled Claim 1 and independent method Claim 90 corresponds, in general, to cancelled Claim 44. The remaining claims generally restore the subject matter of claims which were cancelled in the Preliminary Amendment filed with the Application to eliminate multiple-dependent claims from the Application.

A Substitute Specification and Abstract which are in formats customary for U.S. patent applications and which are also expressed so as to be less stilted and more readable in idiomatic English are submitted herewith.

The invention is directed to an apparatus and method of increasing the yield and quality of the milk produced by an animal such as a cow. This is accomplished by measuring the effects of stress on individual animals, which effects vary from animal to animal. However, these stresses can have, at least for the animals which they effect, an adverse consequence on the quantity and quality of milk produced by such animals. Thus by having a knowledge of the stresses which have caused particular animals to produce less milk or milk of lesser qualities or both, it is possible to reduce such stresses or, in some cases, to utilize them favorably whereby the result is an increase in the quantity and quality of milk from the animal concerned. In the cited references, it is correctly pointed out that physiological changes in the animal being milked may be evidence that the animal is ill or is in heat. In order to differentiate these physiological changes from the physiological and behavior changes or stresses which are relevant to the instant Application these stresses involved have, in the instant Application in independent Claims 53 and 90 been termed "relatively momentary stresses." Similar terminology, "momentarily measured values" of stresses, are set forth in the Specification. (pp 6, 7 and 11 of the Substitute Specification). Those such as the animal being ill or in heat or having mastitis which are disclosed in the prior art are substantially different in degree and can hardly be considered as relatively momentary stresses, and are not described as "stresses" as such. Thus the instant invention is directed towards determining what relatively momentary stresses cause milk producing animals such as cows to produce milk in less quantity and quality than anticipated and then to remove or otherwise neutralize or, in some cases, utilize these relatively momentary stresses to increase the quantity and quality of milk being produced. Different relatively

momentary stresses have different effects on different milk producing animals and, accordingly, an important aspect of the invention is to discover the stresses and relate them to milk production from the individual animals.

In the Official Action on page 2, paragraph 2, Claims 37-40 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing particularly to point out and distinctly to claim the subject matter which the inventors regard as their invention. In specific cases in such claims it was pointed out that appropriate antecedent basis for components in the claims is missing and therefore the claims are unclear. However, inasmuch as Claims 36-40 have, in effect, been rewritten and incorporated in Claim 51 and Claim 51, so amended, has been indicated as allowable it is submitted that the rejection under 35 U.S.C. §112 no longer applies and Claim 51 should be allowed. This is also true with respect to Claim 52 which is dependent on Claim 51 and also Claims 87 and 88 which correspond to Claims 42 and 43 that were dependent on Claims 36 and 42 that should, as now being dependent on Claim 51, be allowed. In other words it is submitted that Claim 51, 52, 87 and 88 are allowable. *Claim 87 rejected to §*

Claims 1 and 2 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,816,190, to van der Lely, which issued October 6, 1998. It is stated that this reference discloses an apparatus for milking animals provided with a milking compartment 5 having a medical instrument 36 by means of which the heartbeat, temperature, the blood pressure, etc. of cow 7 in the milking compartment 5 can be measured and the data supplied to a computer. It is further stated that such parameters being indicators of stress, the data therefrom can be collected while the animal is in the milking compartment and supplied to a computer whereby the physical state of the individual animals can be stored so that historical data can be collected. If the data differs sufficiently from what is expected, the dairy farmer's attention is drawn thereto by means such as a print-out of the computer and the device is suitable for and can be adapted to measuring

the data before, during and after milking depending on when one wants to examine the animal, and further the instrument provides output data indicative of a specific condition of the animal. Actually, however, the medical instrument 36 is intended to be used while the cow is in the milking compartment and its purpose is that the physical state of each animal can be kept up to date in the computer. However, an indication from the parameters can be an indication to the farmer that an animal is "ill or in heat." See column 3, lines 36-38. There is no suggestion that they be utilized to disclose that the animal is being stressed or, more particularly, as set forth in Claims 53 and 90 that a determination is being made of the degree of relatively momentary stress or that the data should be stored in the computer as a measurement of the animal's degree of relatively momentary stress being experienced by the animal incidental to the milking process before and during milking. Attention is also invited in the reference to column 6, line 64, to column 7, line 4, wherein it is stated that "during milking," the heartbeat, the blood pressure and the temperature of the animal are measured by the medical instrument 36. It is further stated that when one of the aforementioned parameters deviates too much from the average value this should be printed on an attention list to alert the farmer that he should inspect the animal or consult a veterinary. Although in the instant invention the inventors are concerned about the stress measurement being too high, its deviation from an "average value" is not, as such, involved. In fact, usually generally it is the opposite, the inventors desire to reduce the "average value" by reducing or eliminating the stress involved. The primary purpose of the apparatus for milking animals in the van der Lely reference is to determine when an animal is sick or in heat. In contrast, the instant Application, the inventors desire to decrease or eliminate what may have been, to the animal involved, the average value. The instant invention not only goes beyond but also is different than the inventive concept in the van der Lely reference and, as such, it is submitted that Claims 53 and 90 are allowable.

In the Official Action, page 3, paragraph 6, Claims 1, 2 and 36-39 were rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,697,326, to Mottram et al, which issued December 16, 1997 and is entitled "Examination of Ruminant Animals," in view of U.S. Patent No. 5,873,323, to van den Berg et al, that issued February 23, 1999, which relates to a method of milking animals automatically while determining their physiological condition. In the Official Action it is stated that Mottram et al disclosed a device which is capable of use in conjunction with a milking apparatus for routine testing and that the examination may be applied when an animal presents itself for milking. The reference is stated further to set forth that the device is provided with a stress measuring device in the form of an Olfactory sensor which samples odors from the animal's teat and exhaled breath to identify specific aspects of the animal's condition and which is therefore capable of determining the degree of stress "off an animal" and supplying the stress measurement data to a storage device. Concerning van den Berg et al, it is stated to teach a method of milking animals automatically while determining their physiological condition with an apparatus that can include a sensor that works in conjunction with a computer that records and compares data with other stored values such as a correspondence table, whereby the results of the comparison are indicative of a physiological condition of the animal. It is also stated that although it is not disclosed that the device of Mottram et al stores data, it would have been obvious to one of ordinary skill in the art at the time the invention was made to configure the electric circuitry of the device to record the sensor results as taught by van den Berg et al in order to develop a pattern of historical data which could be helpful in the treatment or utilization of the animal.

In the van den Berg et al reference the milk conduit system leading from the teat cups has sensors to measure a variety of parameters and provide data to a computer for processing and presenting data which the computer receives from sensors. It is pointed out that the data

received for ill or animals in heat differs from those of healthy animals and animals not in heat whereby the sensors are detecting and the computer is processing and determining on the data provided in the sensors on a continuing basis which animals are and are not healthy or in heat.

The patent to Mottram et al basically relates to a method and apparatus for sampling odors from at least one part of an animal with an Olfactory sensor. In column 1, lines 18-22, of Mottram et al, it is stated that an object of the invention is to provide a technique for examination of the condition and health of a ruminant animal and more particularly one that can be applied in milking animal husbandry whether as a part of a manual or automatic milking regime or independently. In column 5, in the paragraph starting on line 16 and ending on line 21, it is stated that a breath examination can be done regularly without the intervention required for a blood test. It is relatively cheap and can be carried out at milking time and used as a control input for a milking regime control system relating to feeding and milking and other aspects of the regime. It is also indicated that the sensor can be mounted on a milking robot.

The Mottram et al reference is basically directed to a smell or odor sensor which can be used in the milking system. But other than for sanitary purposes and as relates to feeding and milking, there is no suggestion of utilizing the apparatus and method of Mottram et al to determine any stress at all, much less relatively momentary stress of an animal in conjunction with the milking process.

The apparatus and method of milking of van den Berg et al involves a number of sensors which are placed in lines leading from the teat cups. As set forth in column 4 in the paragraph commencing on line 23, the sensors provide indications of heat or illness but there is no suggestion, as such, that measurements of the degree of relatively momentary stress of the animal are provided. In fact the term "stress" as such is not a subject and either of the two combined references. Nor does there appear to be any motivation, as such, to add the electronic

devices which, in the Official Action are considered "obvious" for the device of Mottram et al. In this connection, it is a well settled principle that prior patents are references only for what they clearly disclose or suggest and it is not proper use of a patent as a reference to modify its structure to one which prior art references do not suggest.

In addition to the foregoing, the instant invention as virtually all inventions, is a combination of old elements. Therefore, it is not unusual for a Patent Examiner to find every element such as, for example, the Olfactory sensor of Mottram et al, in the prior art. But if identification of each claimed element in the prior art were, as such, sufficient to negate patentability, very few patents would ever issue. Furthermore, rejecting patents solely by finding prior art corollaries for the claimed elements would permit a Patent Examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. To counter this potential weakness in the obviousness construct, the suggestion to combine requirement stands as a critical safeguard against hindsight analysis and rote application of the legal test for obviousness. Indeed, even when obviousness is based on a single prior art references, there must be a showing or suggestion or motivation to modify the teaching that reference. Although that motivation, suggestion or teaching may come explicitly from statements in the prior art it may also be considered implicit from the prior art as a whole. Nevertheless, the evidence must be substantive and conclusory statements standing alone are not "evidence."

In restoring the subject matter of multiple-dependent claims previously cancelled without prejudice, there are now a total of forty-six (46) claims in the instant Application, three (3) of which are independent claims. Accordingly, it appears that an additional fee of \$234.00 is required and our check to cover same is submitted herewith. If this is in error, the Commissioner

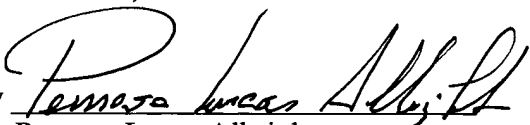
of Patents and Trademarks is authorized to credit or debit our Account No. 13-2000 as appropriate.

Further consideration and reexamination of this Application, in its amended form, is requested in view of 35 U.S.C. §132 and regulations in implementation thereof. It is submitted the Application in its amended form is free from ambiguity and avoids the references of record. It is further submitted the Examiner should have no difficulty in finding that the differences between the subject matter sought to be patented in this Application and prior art and usage within her expert knowledge are such that the subject matter as a whole would not have been obvious at the time the invention was made to persons having ordinary skill in the art to which the subject matter of this Application pertains.

In view of the foregoing, the allowance of claims as now presented is earnestly solicited.

Respectfully submitted,

MASON, MASON & ALBRIGHT

By   
Penrose Lucas Albright  
Registration No. 19,082

2306 South Eads Street  
P.O. Box 2246  
Arlington, VA 22202  
Tel (703) 979-3242  
Fax (703) 979-2526  
**Filed: June 19, 2003**



8553/251

COPY FOR  
MAG. 11

A DEVICE FOR AND A METHOD OF MILKING AN ANIMAL, A DEVICE FOR  
MONITORING AN ANIMAL

# FIELD OF THE INVENTION:

The invention relates to a <sup>apparatus</sup> ~~device~~ for milking an  
5 animal, in particular a cow.

## BACKGROUND OF THE INVENTION:

Such a ~~device~~ <sup>apparatus</sup> is known. Although these ~~known~~ <sup>are</sup> known  
~~devices~~ <sup>apparatuses</sup> function satisfactorily, there ~~appear to be~~ <sup>are</sup>  
differences in milk yield and milk quality which cannot be  
attributed, <sup>as such,</sup> ~~per se~~ to the functioning of the ~~device~~ <sup>apparatus</sup> or the  
10 physical condition of the animals. Consequently, there is a  
need for an improved ~~device~~ <sup>apparatus</sup> for milking an animal.

It is an object of the <sup>invention</sup> ~~invention~~ to provide a  
<sup>apparatus for milking animal</sup> ~~device~~ by means of which it is possible to satisfy <sup>this</sup> ~~the~~ need  
at least partially.

15 For that purpose, according to the invention, a  
~~device~~ <sup>apparatus</sup> for milking an animal of the above-mentioned type is

characterized by the ~~measures mentioned in the characterizing~~ <sup>providing a stress measuring device for determining the</sup>  
~~part of claim 1~~ <sup>transmitting such measurements to storage means such as a</sup>  
degree of stress ~~experienced by the animal due to the milking process~~ <sup>input memory or</sup>  
the milk yield and the milk quality are not only determined <sup>related to</sup>

20 by the physical conditions of health of an animal or the  
functioning of the milking device, but also by the degree of  
stress from which an animal suffers. By measuring, according  
to the invention, the stress of an animal before and during  
and preferably also after milking, there can at least be

25 obtained <sup>in place of</sup> ~~a supplement~~ to the conditions influencing the milk  
yield or the milk quality. These additional data may be used  
for making the milking ~~device~~ <sup>apparatus</sup> function more efficiently. In  
this situation by "milking" is meant milking during a milking  
run.

International Publication No.

In this connection, it is noticed that from  
WO 99 01026, published January 14, 1998, of Hall et al,  
it is known <sup>such as</sup> ~~per se~~ to monitor abnormal behavior  
of an animal, ~~and~~ by means of a movement meter, a  
respiration meter or a heartbeat meter. The milking can for  
example be interrupted when a certain abnormal behavior  
35 gives reason therefor. However, measuring of the degree of

International Patent Application No. 92/51398/01001  
filed July 2, 1998

an input memory or related to the animal's stress before, after and during milking.

stress before and during milking is not known from this document.

*Netherlands Application No. 1 published January 28, 1997, of Dole to Hants,*

Furthermore, from ~~US~~ 1000883, it is known ~~to~~ to use a smell sensor for breath or body odours for animal identification ~~or~~ <sup>or for both purposes</sup> health determination. However, measuring the degree of stress before and during milking is not known from this document.

Furthermore, from WO 00 13393, it is known ~~to~~ to process animal sounds and to supply in dependence thereof a signal to a manager. However, measuring the degree of stress before and during milking is not known from this document.

Furthermore, from US 5 878 692, it is known ~~to~~ to take an action in reaction to the measuring of animal sound, ~~by~~ <sup>and</sup> by opening a gate of a milking robot when the animal is in a panic. However, measuring the degree of stress before and during milking is not known from this document.

Furthermore, from SU 1 329 719 it is known ~~to~~ to measure stress of animals by means of lymphocyte fraction and by measuring the electrophoretic mobility. However, measuring the degree of stress before and during milking is not known from this document.

Furthermore, from EP 0 988 786, it is known ~~to~~ to determine animal sounds owing to stress and, accordingly, automatically to bring about a reaction thereto. In this situation sounds issued by animals are analysed and possibly converted into control commands. Besides, images ~~and~~ <sup>or both</sup> movements may be analysed, if desired. However, measuring the degree of stress before and during milking is not known from this document.

# **SUMMARY OF THE INVENTION:**

In an embodiment of an ~~apparatus~~ <sup>it</sup> according to the invention, ~~the device~~ is provided with means for determining milk related data and the storage device is adapted to store the stress measurement data together with the milk related data. In this manner there can be established a relation between the stress measurement data before, during and after

*of Dole to Hants,*

*of October 23, 1999, International Publication No. 1, 1999, of October 9, 1999,*

*of October 9, 1999,*

*August 15, 1987,*

*XP-002176810, MARY SHEV et al, BUL. 30,*

*dated 23, September 1999,*

*European Patent Office of Herkelt,*

milking and the milk related parameters, such as milk yield, milk quality (fat content, protein content, etc.).

In particular the means for determining milk related data are suitable for determining the milk flow per udder quarter of an animal during milking.

In order to be able to process the data accurately ~~per~~ <sup>for each</sup> animal, the device is preferably provided with an animal identification system and with a central unit provided with a computer having a memory, <sup>for each animal</sup> said memory being adapted to contain ~~per~~ animal data <sup>in</sup> relation to the stress. Additionally or alternatively the data may also be processed ~~for a~~ <sup>for a</sup> group or herd of animals.

It has appeared that for the determination of stress of an animal, ~~per animal~~ different parameters provide a stronger indication of the stress. Consequently it is important to store the stress related data <sup>for each</sup> ~~per~~ animal in the memory and, on determination of the degree of stress of an animal, to use in particular that stress measuring device or that combination of stress measuring devices that provides a clear indication for that animal. This in contrast with the known devices that are used without distinction for all animals. Therefore, the invention also relates to a device for determining the degree of stress of an animal, the device being provided with an animal identification system, various stress measuring devices, a memory for containing an indication which stress measuring device is most suitable for a particular animal, and with an activation device that activates after animal identification the at least one relevant stress measuring device. Out of all possible parameters that can be measured on an animal the following have proved to be extremely suitable, <sup>being</sup> ~~are~~ <sup>indicated</sup> ~~summed up~~ in connection with <sup>a</sup> ~~the~~ device for determining them:

An infrared meter for measuring an infrared image of the animal;

A camera, in particular a video camera, for determining the position of the ears ~~and/or the head and/or~~ <sup>or any combination thereof</sup> ~~the~~ tail of the animal;

A hygrometer for determining the humidity of the fur ~~respectively~~ <sup>or</sup> the nose of the animal;

A movement behaviour meter, such as a video camera, a step counter, for determining the movement behaviour, in particular the movement activity, of the animal;

An eye meter, such as a video camera or iris scanner, for determining the eye characteristics of the animal;

A smell meter or odour meter for determining the breath or body odour of the animal;

A muscular tension measuring device, such as a muscle contraction meter or video camera, for determining the muscular tension of the animal;

A video camera for determining whether the animal has its tongue outside its mouth;

A blood analyzer for determining the concentration of blood components, such as oxygen, hormones, <sup>or</sup> blood cells, of the animal;

An excrement analyzing device for determining the characteristics of the excrement of the animal;

A heartbeat meter for determining the heartbeat of the animal;

A thermometer for determining the temperature of the animal; <sup>and</sup>

A muscle vibration meter for determining the muscle vibrations of the animal.

The invention also relates to a device for monitoring an animal, in particular a cow, the device comprising a stress measuring device for determining stress of the animal, characterized in that the stress measuring device comprises a device selected from the group consisting of an infrared meter for measuring an infrared image of the

animal, a hygrometer for determining the humidity of the fur  
~~respectively~~<sup>or</sup> the nose of the animal, an iris scanner for  
determining the eye characteristics of the animal, a smell or  
odor meter for determining the breath or body odor of the  
5 animal, a muscular tension measuring device for determining  
the muscular tension of the animal, an excrement analyzing  
device for determining the characteristics of the excrement  
of the animal, <sup>and</sup> a muscle vibration meter for determining the  
muscle vibrations of the animal. ~~Advantageous embodiments are~~  
10 ~~described in the subclaims.~~

To be able to monitor the well-being of a dairy cow  
and also to increase the milk production, in a preferred  
embodiment of a device according to the invention, the device  
is disposed in a milking parlour <sup>compartment of the</sup> and/or a foremilking ~~parlour~~  
15 ~~and/or in a cleaning box for cleaning certain parts, such as~~  
the teats of the animal, ~~and/or in a post-treatment, box.~~ <sup>or a compartment for any</sup>  
There is preferably disposed a milking robot in the milking <sup>combiner for</sup>  
~~parlour.~~ <sup>thereof</sup>

For the purpose of facilitating ~~the~~ data  
20 transmission, the stress measuring device is provided with a  
buffer memory for containing a number of measurement data. As  
a result thereof the measurement data <sup>do</sup> have not to be  
transmitted or read continuously. For that purpose the stress  
measuring device is preferably provided with a transmitter  
25 for transmitting data. The stress measuring device is  
preferably provided with a receiver for receiving <sup>in an</sup> a  
transmission, order, so that energy ~~can be~~ <sup>is</sup> saved and the  
stress measuring device can be driven for a long <sup>period</sup> time on <sup>these</sup>  
batteries, <sup>or other limited energy sources.</sup>

30 Although it is possible to process the data <sup>for each</sup> per  
stress measuring device separately, for obtaining an accurate  
indication the device is preferably provided with a central  
unit comprising a computer having a memory for processing  
measurement data measured by the stress measurement device.  
35 As a result thereof it is possible to combine in a simple

manner different parameters for obtaining a stress indication. This central unit is in particular provided with a reading device for reading the stress measuring device.

When the central unit comprises a correspondence table, said correspondence table containing <sup>for each</sup> ~~for~~ animal stress related data, such as <sup>not only</sup> ~~limit~~ values, historical data and tolerance ranges, there <sup>provided</sup> ~~can not only~~ be ~~given~~ an indication of the momentarily measured value of a stress parameter, but <sup>can be obtained</sup> ~~there can also be obtained~~ an indication whether the momentarily measured value leads to special action, <sup>by, for example</sup> ~~others~~ the farmer. For that purpose in particular the central unit is provided with a comparing device for comparing the measurement data with the data in the correspondence table ~~and/or~~ for comparing the stress measurement data obtained before, during, and preferably also after milking during a milking run, <sup>on for doing so.</sup> The computer is preferably loaded with a program for giving, on the basis of the comparison of the comparing device, an indication about the amount of stress of the animal.

After comparison of the momentarily measured values of the parameters with the correspondence table <sup>on</sup> ~~respectively~~ after mutual comparison of the stress measurement data, there can also be <sup>provided</sup> ~~given~~ an indication whether the animal runs the risk of showing stress, <sup>such as</sup> ~~eg~~ by comparing the stress pattern in successive measurements. For that purpose the computer program is preferably suitable for giving a prognosis of the stress behavior.

The parameters <sup>providing</sup> ~~giving~~ an indication of stress varying per animal, it is advantageous when the device is provided with various stress measuring devices, the computer containing an algorithm for attributing a weighing factor to a particular stress measurement data.

For the purpose of displaying the processed data, the central unit is provided with a signal issuing device for issuing a signal after receipt and processing of the stress

measurement data. The signal preferably produces an image on a display screen, printer or the like <sup>providing</sup> giving information about the stress behaviour of the animal.

The device comprises an animal identification system <sup>of an open type</sup> known per se. Such an animal identification system provides the possibility of collecting the measurement data <sup>forward</sup> for an animal, comparing them and the like. The invention also relates to an animal identification system comprising means for connecting the animal identification system with a GPS-system. This makes it possible to determine the position of an animal, <sup>for example</sup> a cow, in a shed. As a result of the fact that the position can be determined, ~~there can be made use of~~ <sup>can be used</sup> an automatic analysis vehicle that traces an animal and determines the stress parameters on the spot. The invention also relates to such an automatic GPS-controlled analysis vehicle for determining stress parameters. Such a vehicle may also contain the central unit.

The device preferably comprises a stress measuring device, ~~the~~ stress measuring device preferably supplying a signal to an alarm device on the basis of the stress measured.

The invention also relates to a method of milking an animal, in particular a cow, characterized in that the method comprises the step of determining stress of the animal before and during, and preferably also after milking. ~~Advantageous embodiments are described in the subclaims.~~

#### BRIEF DESCRIPTION OF THE DRAWINGS?

The invention will now be explained in further detail with reference to the accompanying figures, in which:  
Figure 1 is a side <sup>elevation</sup> view of a first embodiment according to the invention; and

Figure 2 <sup>shows</sup> a second embodiment of a device according to the invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION:

Before ~~going~~ more deeply into a description of the embodiments of the invention, first the basis of the

invention will be described briefly. Stress can manifest itself by various behavioural reactions, possibly in combination with physiological reactions. In particular on the basis of the specific combination of such reactions, a stress reaction can be distinguished from a physical adaptation to a changing environment. In other words, there does not exist one parameter for <sup>equiv.</sup> univocally indicating stress, although one parameter appears to provide a stronger indication of the degree of stress than another parameter.

10 <sup>for each</sup> ~~For each~~ animal there appears to be a particular parameter, or a limited number of parameters, which with regard to the determination of stress is <sup>100% sure or in combination,</sup> ~~more~~ more important than other parameters. Therefore, combining different parameters, in particular behavioural parameters and physiological parameters, provides an improved monitoring of an animal.

15

The invention can be applied to all animals, but hereinafter the invention will be explained in a non-limiting <sup>manner</sup> ~~way~~ with reference to dairy cows 2, as shown in Figures 1 and 2. When dairy cows 2 are nervous or stressed, in particular before, during and after milking, they appear to behave restlessly, accentuated by frequent movements of the body, stepping or kicking with one of the hind legs. Additionally important physiological systems appear to be activated, as a result of which inter alia the production of hormones, the heart beat rate, <sup>and</sup> plasma concentrations of the blood are influenced. A comparison of the situation before and during, and preferably also after milking, may provide useful information.

25

The increased production of adrenaline before and during milking is highly undesirable, as adrenaline influences the concentration of oxytocin that stimulates the milk yield.

30

Behaviour <sup>X</sup> (stepping; kicking; position of head, tail, ears); heart beat; blood samples inter alia for analysis of oxytocin, cortisol, adrenaline, noradrenaline,

35



percentage of oxygen, content of blood cells and the like, are constantly <sup>that is</sup> ~~the~~ regularly or continuously) measured. In particular these parameters are measured before and during, and preferably also after milking, and milk related data, such as fat content, protein content and the like, are preferably stored. In particular the stress related data together with the milk flow <sup>for each</sup> ~~per~~ udder quarter of animals are stored during milking. An animal identification 22 ensures that these data are stored <sup>per</sup> ~~for~~ animal.

Heart beat can for example be measured by means of a band 17 around the leg or the abdomen of <sup>a</sup> ~~the~~ cow 2. Alternatively or additionally a heart beat meter <sup>a</sup> ~~known~~ <sup>known device</sup> may be disposed on <sup>a</sup> ~~the~~ cow 2 near a place where an artery is located, in this connection the udder, or an ear of the cow can be taken into consideration. A suitable heart monitoring system can for example be obtained with <sup>a</sup> ~~a~~ Polar Electro Oy, Helsinki, Finland. Alternatively a heart beat meter can be included in at least one of the teat cups 4.

Blood samples can be taken by suitable devices, comprising a syringe and analyzing equipment 15, at places where a cow 2 regularly stays. There may for example be provided in a milking robot 3 (Figure 1) a robot arm carrying a syringe taking automatically a blood sample during milking without ~~the~~ treatment of <sup>a</sup> ~~the~~ cow 2 being hindered thereby. Such a device may <sup>for example</sup> also be disposed <sup>a</sup> ~~in~~ in the cubicle 23 with cushion 24 (Figure 2), <sup>a</sup> ~~a~~ feeding stations or the like. There may also be provided an automatically controlled vehicle containing such a blood sample <sup>a</sup> ~~device~~ device, and possibly other stress measuring devices. Such an automatically controlled vehicle preferably comprises an animal identification system and may inter alia be GPS-controlled. To that end the vehicle comprises a computer with transmitter-receiver, so that the computer is able to receive data from the GPS-system <sup>a</sup> ~~about~~ the position of <sup>a</sup> ~~the~~ cow 2 that wears for that purpose a special transponder 22. Thus the



is possibly connected with several reading devices disposed at several places in the shed. Said central unit 20 comprises a computer having a memory in which, <sup>for each</sup> ~~per~~ cow 2, limit values and tolerance ranges in relation to the relevant parameters for stress behavior <sup>behavior</sup> are stored. The momentary measured values are ~~kept~~ <sup>retained</sup> at least temporarily.

For analyzing the stress related data, such as the number of steps, position of the head, binomial and Poisson distributions, <sup>which are</sup> ~~known~~ ~~parameters~~, as well as logit and log transformations are applied by the computer, for causing the central unit 20 to issue a signal <sup>on</sup> ~~about~~ the stress behavior of the cow. This signal can give an indication of the stress behavior on a display screen 21 or a printer. In particular the dispersion of the Poisson distribution is estimated by the Pearson chi-quadratic statistics. Furthermore, associations between different parameters are deduced from Spearman's rank-order correlation coefficient. By means thereof, or by means of comparable other operations, it is possible to deduce <sup>for each</sup> ~~per~~ cow 2 those parameters that are more relevant to the determination of stress behavior than other parameters. Thus there can be attributed a weighing factor to particular parameters. Moreover, it is then possible to distinguish whether a cow 2 is keen on entering <sup>the</sup> ~~the~~ milk <sup>compartment</sup> ~~box~~ 1 or on the contrary is not so eager to be milked. This can further be deduced from the degree of stress during or after milking. When for example the degree of stress is high before milking, but strongly decreases during milking, it can be deduced therefrom that the cow has a so-called positive stress prior to being milked.

30 A comparison is possible when previously measured standard values are determined and inputted into the system. Furthermore, these standard values can continuously be updated on the basis of the measurements.

As described, Figure 1 is a side view of a milk <sup>compartment</sup> ~~box~~ 1 with a cow 2 present therein. <sup>compartment</sup> ~~The~~ milk ~~box~~ 1 is provided

with a milking robot 3 with teat cups 4 that can be connected automatically to the teats of ~~the~~ cow 2 with the aid of ~~the~~ milking robot 3. Near the front side of ~~the~~ milk box 1 <sup>component</sup> ~~there~~ is further provided a feeding trough 5 <sup>is provided</sup> to which concentrate 5 can be supplied in metered portions. Other components of the milk <sup>my component</sup> ~~box~~ and milking robot are not shown in the drawing for the sake of clearness.

As described, Figure 2 shows a cubicle 23 with a cushion 24 on which a cow 2 is able to lie. In such a cubicle 10 23, a cow 2 can rest, ruminate and the like. For the sake of simplicity only a few possible components are shown, such as a camera 7, smell meter 12, thermometer 18, and <sup>an</sup> animal identification <sup>means</sup> 22, but it will be <sup>understood</sup> ~~obvious~~ that also other stress measuring devices as described above can be used.

15 The invention also relates to making use of the stress of an animal for the purpose of managing ~~and/or~~ or both monitoring <sup>a</sup> herd of animals. To that end the device is further provided with an animal identification system <sup>represented by means</sup> 22 ~~known per se~~ <sup>which are well known in the art</sup>. This animal identification system 22 contains 20 reading devices for reading an animal identification <sup>means</sup> 22 worn by an animal, in particular a cow. As known, data from the animal identification <sup>system</sup> are centrally stored by a central unit 20 provided with a computer having a memory containing several memory files. ~~The~~ Central unit 20 centrally controls 25 the functions of the device.

<sup>for each</sup> According to the invention the memory is provided ~~per~~ animal of the herd with data in relation to the stress of the ~~animal in the herd~~ <sup>at</sup>. These data can initially be inputted with the aid of data based on experience as known to the <sup>farmer</sup> 30 farmer. The data in relation to the hierarchic order and the jostling behavior can additionally automatically be <sup>maintained</sup> ~~kept~~ and updated by the device.

The functioning of the device according to the invention will be explained in further detail with reference 35 to the entrance to a milking <sup>component</sup> ~~parlor~~. However, it will be

*appreciated*

~~obvious~~ that the invention is not limited to this example, but can be applied to all automatic animal related treatments that are customary in managing a herd of animals.

When dairy animals wish to make use of ~~the~~ milking robot 3 in ~~the~~ milking <sup>compartment</sup> ~~parlour~~ 1, they first have to enter a waiting area via one of a number of entrance gates. When it is detected that one of the animals in front of the entrance gates shows such a high stress that milking by ~~the~~ milking robot 3 <sup>is undesirable</sup> ~~would be unjustified~~ at that moment, then the relevant entrance gate is blocked. Other, non-stressed animals can use one of the other entrance gates. The detection takes place by a <sup>known</sup> reading unit ~~known~~ ~~per se~~. During milking the stress can be measured by means of stress measuring devices present in the milking <sup>compartment</sup> ~~robot~~.

15 A dairy animal that has been ~~milking~~ by ~~the~~ milking robot 3 can leave ~~the~~ milking <sup>compartment</sup> ~~parlour~~ 1 via exit gates. Also in this situation the operation of the exit gates can be controlled partially on the basis of the stress of the animal. Thus it is possible to guide a stressed animal to a  
20 calming area via the exit gates.

The gates controlled by ~~the~~ central unit 20 <sup>and</sup> thus ~~provide~~ <sup>may</sup> the possibility of guiding an animal in dependence ~~of~~ <sup>on</sup> the degree of stress. <sup>is provided</sup> For the determination of the degree of stress one of the above described stress measuring devices  
25 can be used. In particular a stress measuring device can supply a signal to an alarm device in dependence of the degree of stress measured. Such an alarm signal may be an audible or visible signal, but may also be a call via a telecommunication network to the <sup>during</sup> farmer or a service  
30 department.

*Although we have disclosed the preferred embodiment of our invention it is to be understood that it is capable of other adaptations and modifications within the scope of the following claims:*